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A NEW DWARF CRAWFISH (DECAPODA: CAMBARIDAE: CAMBARELLINAE) FROM SOUTHWEST ALABAMA AND ADJACENT MISSISSIPPI

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The dwarf crawfishes, genus *Cambarellus,* are essentially a group of species of the coastal area of the Gulf of Mexico within the United States, although they also occur on the central plateau and Pacific slope in Mexico. For a number of reasons, they are sufficiently distinct to be placed in the monogeneric subfamily Cambarellinae (Hobbs, 1974a). In all of the United States species the mesial process of the first pleopod of males is ungrooved, and only in *C. shufeldtii* (Faxon, 1884) are the three terminal elements straight. The extreme of curving occurs in *C. ninae* Hobbs (1950) in which the terminal elements are bent caudally at least 90° to the main plane of the pleopod. *C. texanus* Albaugh and Black (1973) is the only described species not keyed by Hobbs (1972) and also figured by him (1974b).

The species here treated was discovered by Leslie Hubricht in 1968 and elicited correspondence between Horton H. Hobbs, Jr. and the senior author, but only recently have sufficient specimens been collected to permit its description. Mr. Hubricht and Dr. Hobbs have generously lent their specimens for the preparation of this description. We are also indebted to the collectors indicated in the appropriate places.

This newly described species has appeared several times in the literature under the appellation *Cambarellus schmitti* (see synonymies). There is a close morphological similarity between it and *schmitti*; until recently the collections were limited in number and size, particularly with respect to first

form males, and most of the citations are reiterations of earlier literature statements which had been based on even more limited knowledge. More extensive collecting and subsequent better understanding of *Cambarellus* in the southeast have revealed that some of the records for *C. schmitti* are based on misidentifications of *C. lesliei* and other, yet undescribed, taxa.

Cambarellus lesliei, new species

Figure 1.

Cambarellus schmitti.—Hobbs, 1942: 151(part); Hobbs, 1968:K-12 (part); Hobbs, 1972:26(part), 145(part), 154(part); Hobbs, 1974b: 9(part).

Diagnosis: Body and eyes pigmented. Rostrum acuminate with margins slightly converging cephalically and terminating in strong, acute spines. Postorbital ridges well developed and terminating cephalically in acute spines. Suborbital angle prominent but obtuse. Single acute cervical spine on each side of carapace. Areola constituting 27.12–35.66 (av. 31.2)% of total length of carapace, 2.7–4.78 (av. 3.66) times longer than wide. Hooks on ischia of second and third pereiopods only, those of third pereiopod usually bifid; coxa of fourth pereiopod with transversely oriented boss on anteroventral margin. Chela markedly longer than wide; length of dactyl and length of inner margin of palm approaching subequal; chela surfaces not punctate and with only scarce setiferous ornamentation located chiefly along opposable margins of fingers; opposable margins of both fingers with crowded minute denticles along entire length but lacking tubercles. First pleopod of male terminating in 3 parts, all curved approximately 80° to main plane of pleopod: (1) central projection shortest of elements and sharply tapering along length to acute tip; (2) mesial process longest and stoutest of elements, lacking groove, tapering along length to acute tip, curved nearly 90° in Form I males; and (3) caudal process subsetiform, subparallel to central projection and only slightly longer. Annulus ventralis of female about twice as wide as long, highest point along cephalic margin; deep groove in centrocaudal face receiving flange from cephaloventral surface of subtriangular postannular sternite.

Holotypic male, Form I: Body subovate, slightly compressed laterally. Abdomen longer than carapace (13.59 and 9.63 mm, respectively). Areola moderately long (33.02% of total length of carapace), 3.21 times longer than wide, and with 4–5 punctations across narrowest part (Fig. 1h). Cephalic part of carapace 2.03 times longer than thoracic part. Rostrum only slightly depressed in distal fourth (Fig. 1b); with lateral margins slightly thickened and terminating cephalically in strong spines which extend half length of well developed acumen; excavate dorsally, with scattered setiferous punctations across entire surface and with usual

submarginal row of punctations. Subrostral ridges well developed and visible in dorsal aspect to about level of suborbital angle. Postorbital ridges well developed, terminating cephalically in strong spine extending beyond postorbital margin of carapace. Branchiostegal spine small but acute. Single cervical spine on each side of carapace. Carapace punctate dorsally and laterally with low squamous tubercles developed cephalolaterally. Cephalic part of telson with 3 spines in right caudolateral corner and 2 in left.

Cephalic lobe of epistome (Fig. 1f) subtriangular in outline with slightly thickened margins; lacking cephalomedian tubercle.

Antennules of usual form; lacking spine on ventromesial surface of basal segment. Antennae broken; antennal scale (Fig. 1i) 2.24 times longer than wide, broadest near distal margin of lamellar portion, thickened lateral part terminating in strong acute spine.

Right chela (Fig. 1j) only moderately depressed; with palm inflated, subelliptical in cross-section, length of inner margin of palm longer than dactyl (in illustration palm somewhat foreshortened due to position when drawn). Opposable margin of both movable and immovable finger lacking tubercles but with crowded minute denticles along entire length; few setae arising just off margins; submedian ridges poorly defined on fingers above and below. Fingers curved gently downward (Fig. 1k). Entire palmar and dactylar surface relatively devoid of punctations and setae.

Carpus slightly longer than broad, lacking prominent punctations or spines, except strong, acute spine on distomesial margin. Merus with acute spine on distolateral margin; acute spine at base of distal fifth of upper surface; acute spine near midlength of lower surface. Margins of ischium entire.

Ischiopodites of second and third pereiopods with hooks (Fig. 1l); that of second pereiopod subrhomboidal and with cephalodistal third compressed; hook on third pereiopod larger, acute and extending beyond proximal margin of ischiopodite. Coxa of fourth pereiopod with strong cephalomesial boss directed laterally.

First pleopod reaching coxopodite of third pereiopod; pleopods symmetrical (e.g., Fig. 1m). Tip terminating in 3 distinct parts; only central projection corneous; cephalic process absent; parts arranged as in diagnosis (Figs. 1a,c).

Allotypic female: Differing from holotype only in minor respects except in proportions of chela (Fig. 1n): dactyl longer than inner margin of palm and palm slightly wider; right caudolateral corner of cephalic section of telson with only 2 spines.

Annulus ventralis subovoid (Fig. 1o); highly raised (ventrally), highest along cephalic margin; deep vertical groove in mid-caudal surface receiving flange from postannular sternite; sinus originating near right cephalolateral margin at about mid-height and arcing around caudal margin and disappearing in mid-caudal groove. Postannular sternite subtriangular in outline, with prominent median ridge becoming more

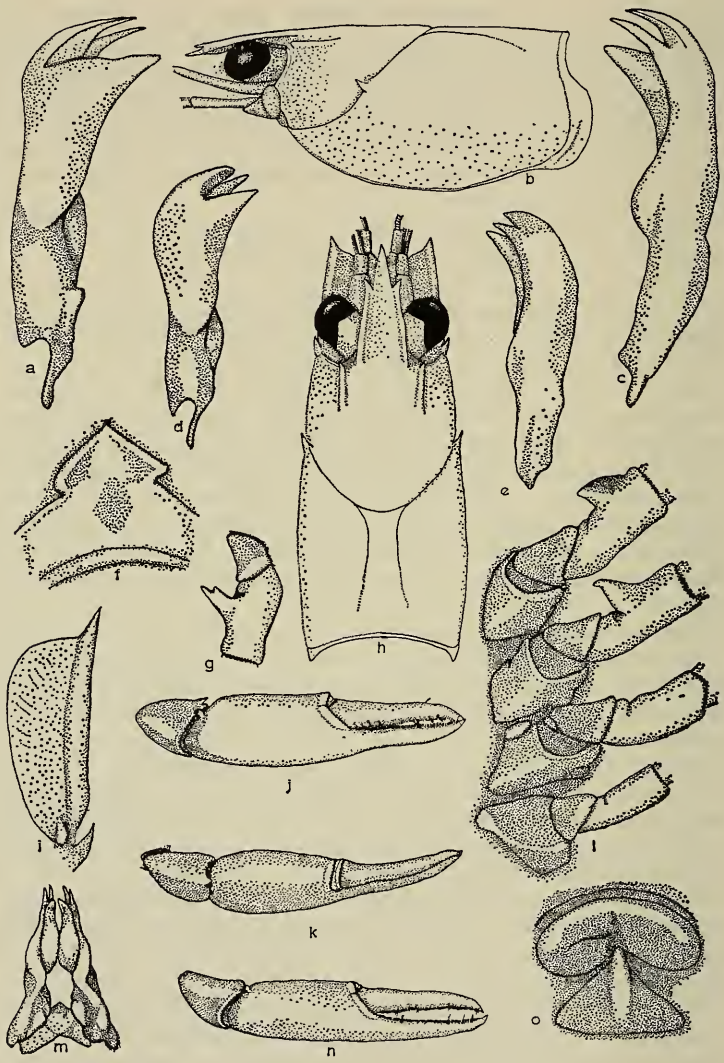

Fig. 1. *Cambarellus lesliei* new species (all holotype except d, e, g, m, n, o). a, Mesial view of first pleopod; b, Lateral view of carapace; c, Lateral view of first pleopod; d, Mesial view of first pleopod of morphotype; e, Lateral view of first pleopod of morphotype; f, Epistome; g, Ischium and basis of third pereiopod of paratypic male, Form I; h, Dorsal view of carapace; i, Antennal scale; j, Dorsal view of distal podomeres of cheliped; k, Mesial view of distal podomeres of cheliped;

TABLE 1. Measurements of type-specimens of *Cambarellus lesliei* n. sp. (in mm).

	Holotype	Allotype	Morphotype
Carapace—			
length	9.63	10.11	7.38
width	4.14	4.65	3.18
height	4.86	5.35	3.24
Areola—			
length	3.18	3.15	2.34
width	0.99	0.93	0.69
Antennal scale—			
length	2.82	2.46	1.77
width	1.26	0.99	0.84
Rostrum—			
length	2.97	2.94	2.64
width	1.38	1.74	1.14
Chela—			
length of inner margin of palm	3.12	2.82	1.80
width	1.86	1.71	1.20
total length	6.69	6.39	4.20
dactyl length	2.76	3.21	2.10

elevated cephalically and overhanging margin forming flange; except when abdomen fully extended, flange fitting into mid-caudal groove of annulus.

Morphotypic male, Form II: Differing from holotype in following respects: dactyl longer than inner margin of palm; hooks on ischia of pereiopods scarcely more than tubercles; boss on coxae of fourth pereiopods much less well-developed; right caudolateral corner of cephalic part of telson with 2 spines. Terminal elements of first pleopod (Figs. 1d,e) more blunt, all non-corneous; central projection and caudal process proportionately shorter.

Type-locality: 0.5 mi S of Alabama Port, Mobile County, Alabama.

Disposition of types: The holotypic male, Form I; the allotypic female; and the morphotypic male, Form II, are in the National Museum

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l, Proximal podomeres of third through fifth pereiopods; m, Caudal view of first pleopods of paratypic male, Form I; n, Distal podomeres of cheliped of allotype; o, Annulus ventralis of allotype.

of Natural History, Smithsonian Institution (USNM 146616, 146617, 146618, respectively). Paratypes are in the collections of NMNH (31 ♂♂I, 11 ♂♂II, 22♀♀, 6♀♀/ov., 5♀♀/young—including the topotypic series), Tulane University (6♂♂I, 8♂♂II, 20♀♀, 3♀♀/ov., 2♀♀/young) and the senior author (12♂♂I, 16♂♂II, 17♀♀, 4♂♂ juv., 1♀/ov.).

Specimens examined: Alabama: Baldwin Co.—Bayou Minette [Bay Minette Creek] on U.S. Hy. 31, T4S, R2E, 12 April 1941, Hubbs and Walker (12♂♂I, 3♀♀, 1♀/young); Creek on St. Rte 59, about 13.5 mi N of Stockton, 19 April 1970, Hollingsworth and Hobbs, Jr. (3♂♂I, 7♂♂II, 4♀♀, 1♀/ov., 2♀♀/young); Creek just N of L&N RR, 2.1 mi N of St. Rte. 138 on St. Rte. 225, 24 November 1973, JFF and BAL (1♂I, 5♂♂II, 1♀); d'Olide Creek at Spanish Fort, just S of U.S. Hy. I-10, 18 February 1974, L. Curtis (1♂II, 1♀, 1♀/ov.); Flat Creek at St. Rte. 59, 2 mi E of Stockton, 6 August 1960, J. Bohlke family (1♂I, 2♀♀); Mobile Co.— 2.5 mi S of Bucks on U.S. Hy. 43, 3 June 1940, Hobbs, Jr. and L. J. Berner (5♂♂I, 4♀♀/ov.); type-locality, 11 February 1968, Hubricht (2♂♂I, 3♂♂II, 5♀♀); Washington Co.—Bilbo [*sic*!] Creek on U.S. Hy. 43, T3N, R1E, 12 April 1941, Hubbs and Walker (7♂♂I, 6♀♀, 1♀/ov., 2♀♀/young); Bassett Creek, 5.1 mi E of Chatom on U.S. Hy. 84, 21 June 1966, J. F. Payne and S. M. Chien (11♂♂I, 10♂♂II, 15♀♀); Biloba Creek, 2.5 mi S of McIntosh on U.S. Hy. 43, 21 June 1966, JFP and SMC (6♂♂I, 8♂♂II, 20♀♀, 3♀♀/ov., 2♀♀/young); Bassett Creek, 1.6 mi N of Chatom on St. Rte. 16, 22 April 1970, E. Black and Hobbs, Jr. (1♂II, 1♀); Creek 9.1 mi N of McIntosh on U.S. Hy. 43, 25 November 1973, BAL and JFF (1♂I). Mississippi: George Co.—Creek under St. Rte. 26, 3 mi E of Pascagoula River, 5 August 1960, J. Bohlke family (2♂♂I, 1♂II, 1♀); 4.3 mi S of Greene County line on St. Rte. 57, 22 June 1966, JFP and SMC (1♂I, 14♂♂II, 12♀♀, 4♂♂ imm.).

Variations: Besides the usual variations in degrees of development of spinose ornamentation and the sexual and other differences noted in the descriptions of the types, the following variations were noted. The holotype is atypical in that the hooks of the third pereiopod are not bifid; indeed, in 81.8% of all Form I males the hooks are quite clearly bifid (Fig. 1g) and in only 13.6% are the hooks clearly simple. In 91.4% of the males a well-developed boss is to be found on the cephalomedian surface of the fourth pereiopodal coxa. This characteristic, not previously considered in descriptions of *Cambarellus*, is, none the less, present in several species. In response to a question, Hobbs, Jr. (personal communication) examined specimens of several United States species, finding a well-developed boss in *texanus* and *puer*, a moderately developed one in *ninae* and two undescribed species, and a vestigial one in *diminutus*; the boss is absent in *shufeldtii*.

In two females from Baldwin County, Alabama, (*ex* USNM 116004, Flat Creek; *ex* USNM 114213, Bayou Minette) the sinus is flanked by a ridge approaching the condition found in *schmitti*; and in another

female from the latter locality the flange of the postannular sternite is markedly compressed laterally, making it bladelike. Although the prevalent situation is for the sinus of the annulus to be dextral (68.5%), a number of females have a sinistral sinus. Likewise, in many females the sinus is more widely gaping than in the allotype. This gaping cannot be associated with sexual maturity. Surely all ovigerous females and those bearing young are sexually mature, but both the gaping sinus and the closed one can be found in some specimens. No annulus examined had evidence of a sperm plug.

The Mobile River should provide a formidable barrier to dispersion of crawfishes of this size. The central projection of Form I males from east of the river is slightly more slender than in specimens from west of the river. To test the idea of geographic races, the ratios expressing areola length and width, antennal scale length and width and chela length were examined morphometrically in first form males. When tested using the F-statistic, the populations did not differ significantly at the 5% level.

The carapace length values for first form males ranged from 5.97 to 11.34 mm (av. 7.74), that of the maximum sized female was 11.73 (av. size 8.26), and of the largest second form male was 9.69 (av. 6.76); minimum sizes in the latter two catagories are not meaningful because of the difficulty in determining the precise time at which a juvenile becomes mature.

Relationships: *Cambarellus lesliei* is most closely related to *C. schmitti*, *C. puer* and an undescribed species which is located, geographically, between *schmitti* and *lesliei*. It may be distinguished from *schmitti* in that in males, Form I, the central projection and caudal process are bent caudally at an angle of nearly 90° to the main axis of the pleopod, and the latter process is proportionally longer. In females the sinus of the annulus ventralis almost always lacks flanking ridges in adult specimens. The rostral margins are more convergent in *lesliei* than in *schmitti*. First form males of *C. lesliei* may be distinguished from those of *C. puer* in that the mesial process is much broader at its base and the caudal process is subparallel to the central projection. The annulus ventralis of *lesliei* females is clearly broader than long, while the two measurements are subequal in *puer*; the lateral *parts* of the postannular sternite are much less attenuated in *lesliei*. Well-developed marginal rostral spines and a prominent acumen likewise distinguish *lesliei* from *puer*. *Cambarellus lesliei* differs from the undescribed species mentioned in that the central projection and caudal process of the latter are of subequal length. A fuller discussion of the differences will be more appropriate when the species is described.

Life history notes: *Cambarellus lesliei* is apparently a year-round breeder. Ovigerous females were taken in February, April and June, and females bearing young were in April and June collections. Whenever occurring, gravid females constituted 15–33% of the female population, suggesting that the major portion of the adult female population does

not contribute to the reproductive activity in a single breeding season. The stated percentages are probably reasonable estimates of the activity of females, as sex ratios remained 1 : 1 in all months of collection. In every collection period, Form I males were present. These data would seem to be closer to those presented for *C. shufeldtii* by Black (1966) than those for *C. puer*. He is probably correct in his assumption that temperature is a prime factor in establishing the seasons of breeding activity in these crawfishes (p. 231). *C. lesliei* occupies a range not subject to a rigorous winter temperature, as does *shufeldtii*, and in breeding habits it more closely resembles distantly related *shufeldtii* than the more closely related *C. puer*, thus lending support to this temperature-cycle thesis.

Color: Although we have no specific color notes recorded in the field, the specimens were recognized as *Cambarellus* on collection. If there were significant deviations from the colors or color patterns already recorded for the genus, we are sure the field notes would reflect this.

Associates: In areas of sympatry, *C. lesliei* has been collected with *Procambarus* (*Ortmannicus*) *acutus acutus* (Girard), *P.* (*O.*) *bivittatus* Hobbs, *P.* (*O.*) *lecontei* (Hagen) and *P.* (*Leconticambarus*) *shermani* Hobbs. Interestingly, we have no record of it sharing a habitat with *Faxonella clypeata* (Hay), which crawfish is a common associate of *Cambarellus*. (References to descriptions of associates are omitted; interested parties may consult Hobbs, 1974b, for full bibliographic citations.)

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